What is claimed is:

~~1.~~[Claim 1] A sensor for measuring mud resistivity in a borehole, comprising:

a transmitter having a magnetic moment in a first direction; and
a receiver having a magnetic moment in a second direction,
wherein the first direction and the second direction are substantially different,
wherein the transmitter and the receiver are disposed in an insulating collar of a downhole tool, and
wherein the transmitter is disposed at a selected distance no more than 10 inches from the receiver along a longitudinal axis of the downhole tool.

[Claim 2] The sensor of claim 1, wherein the first direction is substantially orthogonal to the second direction.

[Claim 3] The sensor of claim 1, wherein at least one of the transmitter and receiver is on a printed circuit board.

[Claim 4] The sensor of claim 1, wherein the selected distance is no more than 5 inches.

[Claim 5] The sensor of claim 1, wherein the selected distance is no more than 2 inches.

[Claim 6] The sensor of claim 1, wherein the selected distance is about 1 inch.

[Claim 7] The sensor of claim 1, wherein one of the first direction and the second direction is substantially perpendicular to the longitudinal axis of the downhole tool.

[Claim 8] The sensor of claim 1, wherein one of the first direction and the second direction is substantially parallel to the longitudinal axis of the downhole tool.

[Claim 9] The sensor of claim 1, wherein at least one antenna of the transmitter and the receiver comprises a tilted antenna.

[Claim 10] The sensor of claim 1, wherein the transmitter and the receiver are in a module configured to be placed in a cavity in the insulating collar of the downhole tool.

[Claim 11] The sensor of claim 1, wherein the downhole tool is one selected from a wireline tool, measurement-while-drilling tool, logging-while-tripping tool, and a logging-while-drilling tool.

[Claim 12] A sensor for measuring mud resistivity in a borehole, comprising:

a transmitter having a magnetic moment in a first direction; and
a receiver having a magnetic moment in a second direction,
wherein the first direction and the second direction are substantially different,
wherein the transmitter and the receiver are disposed in an insulating collar of a downhole tool, and
wherein the transmitter and the receiver, when projected onto a plane substantially perpendicular to a longitudinal axis of the downhole tool, are separated from each other by an azimuthal angle of less than 90 degrees.

[Claim 13] The sensor of claim 12, wherein the azimuthal angle is no more than 45 degrees.

[Claim 14] The sensor of claim 12, wherein the azimuthal angle is no more than 30 degrees.

[Claim 15] The sensor of claim 12, wherein the first direction is substantially orthogonal to the second direction.

[Claim 16] The sensor of claim 12, wherein at least one antenna of the transmitter and the receiver comprises a tilted antenna.

[Claim 17] The sensor of claim 12, wherein at least one of the transmitter and receiver is on a printed circuit board.

[Claim 18] The sensor of claim 12, wherein one of the first direction and the second direction is substantially perpendicular to the longitudinal axis of the downhole tool.

[Claim 19] The sensor of claim 12, wherein one of the first direction and the second direction is substantially parallel to the longitudinal axis of the downhole tool.

[Claim 20] The sensor of claim 12, wherein the transmitter and the receiver are in a module configured to be placed in a cavity in the insulating collar of the downhole tool.

[Claim 21] The sensor of claim 12, wherein the downhole tool is one selected from a wireline tool, measurement-while-drilling tool, logging-while-tripping tool, and a logging-while-drilling tool.

[Claim 22] A downhole tool comprising a mud resistivity sensor disposed in an insulating portion of the downhole tool, wherein the mud resistivity sensor comprises:

a transmitter having a magnetic moment in a first direction; and
a receiver having a magnetic moment in a second direction,
wherein the first direction and the second direction are substantially different,
wherein the transmitter is disposed at a selected distance no more than 10 inches from the receiver along a longitudinal axis of the downhole tool.

[Claim 23] A downhole tool comprising at least one mud resistivity sensor disposed in an insulating portion of a lowermost section of the downhole tool, wherein the mud resistivity sensor comprises:

a transmitter having a magnetic moment in a first direction; and
a receiver having a magnetic moment in a second direction,
wherein the first direction and the second direction are substantially different, and
wherein the transmitter is disposed at a selected distance no more than 10 inches from the receiver along a longitudinal axis of the downhole tool.

[Claim 24] The downhole tool of claim 23, wherein the at least one mud resistivity sensor comprises two mud resistivity sensors, wherein the two mud resistivity sensors are disposed at a substantially identical location along a longitudinal axis of the downhole tool.

[Claim 25] A method for measuring mud resistivity in a wellbore, comprising:

energizing a transmitter to induce a magnetic field, wherein the transmitter has a magnetic moment in a first direction;

acquiring a voltage measurement using a receiver at a selected location, wherein the receiver has a magnetic moment in a second direction that is substantially different from the first direction, and wherein the selected location is no more than 10 inches away from the transmitter; and deriving a mud conductivity from the voltage measurement.

[Claim 26] The method of claim 25, wherein the transmitter is energized by passing an alternate current having a frequency of at least 400 KHz.

[Claim 27] The method of claim 25, wherein the selected location is no more than 5 inches from the transmitter.

[Claim 28] The method of claim 25, wherein the selected location is no more than 2 inches from the transmitter.

[Claim 29] The method of claim 25, wherein the first direction is substantially orthogonal to the second direction.